THE

DRY COLLODION PROCESS;

BY

ROBERT FREEMAN BARNES.

SECOND EDITION,

CAREFULLY REVISED AND AUGMENTED.

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PREFACE TO THE SECOND EDITION.

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At a time when so many "Dry Collodion Processes" are before the Public, it behoves one to be particularly watchful, lest some of the "prolifically inventive geniuses" now abounding in the Photographic world, take advantage, *sans cérémonie*, of one's discoveries, and turn them to their own especial benefit.

My attention has been called to a paragraph in the Fourth Edition of Mr. Hardwich's "Manual of Photographic Chemistry," in which that gentleman states that "we are indebted to Dr. Hill Norris, of Birmingham, for establishing the theory of the subject [Dry Collodion] upon a more correct basis. He has pointed out [continues Mr. Hardwich] the importance of distinguishing two different conditions of the Collodion surface, viz., — the contractile, common in newly-mixed Collodion, and the short or powdery, in Collodion which has been iodized with the alkaline iodides, and kept until much iodine has been set free."

It so happens that Dr. Hill Norris's so-called "discovery"

[See *Journal of the Photographic Society*, November, 1856] was made several months after the publication of the "important" fact, by me, in my work on the "Dry Collodion Process," issued in May, 1856.

Now, although I have since so far advanced in my experiments as to dispense with the necessity of employing Collodion in a powdery state (obtaining results with *new* Collodion with much greater rapidity and facility than by the use of *old*), still I do not feel, in the slightest degree, inclined to be thus set aside, and to have the credit of my discoveries unceremoniously claimed by, and awarded to, another.

There has been so much said, and so little proved, about the merits of the different Dry Collodion Processes, that I consider there would be a great saving of time and expense to all interested in the subject, were the Photographic Society to make arrangements, at one of their meetings, for the exhibiting, side-by-side, of pictures taken by each of the Dry Methods then published. Photographers would thus have the means of judging of the results obtained by each operator, and be enabled to adopt that process which seemed most suited to their requirements.

I shall be most happy to exhibit on that occasion all the negatives I have taken by my process, and to give any explanations that may be required. No doubt the call would be responded to by many other operators, and we should have a most instructive and entertaining meeting.

In the following pages I have given every detail that is calculated to assist the operator in his manipulations. From numerous communications I have received, I am happy to find that the process has succeeded in the hands of very many photographers, both amateur and professional. I trust that the improvements I have made will cause it to be still more generally adopted.

August, 1857.

PREFACE TO THE FIRST EDITION.

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In bringing the Dry Collodion Process before the Photographic Public, I may be allowed, in justice to myself, to state that, as early as October, 1854, I succeeded in producing negatives upon dried collodionized plates; but being aware that many others, besides myself, were engaged in pursuit of the same object, and imagining that I should not, therefore, be the first to discover a simple and easy method of obtaining pictures upon dessicated collodion, I only carried on my experiments at my leisure.

In the spring of last year I employed all my spare time in making further investigations; the subject proving an exceedingly interesting one, and calculated in my mind to lead to some very curious results.

I found there were a variety of ways of accomplishing the end I had in view, and I was induced by the extreme beauty, joined with wonderful facility of manipulation, of many of the methods, to carry out a much larger series of experiments than I had originally intended. Details of many of these trials will be given in the latter part of this work; but I shall confine myself, in

the body of it, to a description of that process which ensures the best results, and which combines, at the same time, economy with facility of manipulation.

The whole of my experiments were made upon glass plates, 10 in. by 12 in. My principal object was to overcome the great difficulties resulting from the use of large surfaces covered with collodion—difficulties caused by the varying contractibility, or expansibility, of different specimens of collodion when re-wetted previous to, and during, the development of the picture; besides, I well knew that if I succeeded with large-sized plates, success with the use of the smaller sizes would follow as a matter of course.

Although these impediments no longer exist, I should still recommend the beginner to practise upon plates 10 in. by 8 in. or even smaller, as he may at first expect to have to contend with obstacles (almost always attendant upon those who practise a new process) which may prejudice him against my method, but which will rapidly disappear by the exercise of a little patience and perseverance.

*** It was my intention to have issued this pamphlet in July last, but ill health compelled me to abandon my photographic pursuits for several months, and prevented me, also, from producing many specimens for the Exhibition this year.

MAY, 1856.

THE DRY COLLODION PROCESS.

Since the publication of my pamphlet on the above subject, in the month of May of the last year, I have been carrying out a further series of experiments, in order, if possible, to render the process still easier to the tyro; and I have fortunately succeeded in greatly simplifying the manipulation, and in producing likewise a much more sensitive collodion than that at first employed.

The various modifications I have made will be found embodied in the following pages.

I recommended, in the first edition of my work, the use of collodion alone, unsupported by any other substance, as most likely to prove successful in the hands of beginners. Since that time, however, I have found that almost in every case my pupils and others adopt, as being the safer and easier plan, the process described at pages 25 and following of that edition, in which albumen is used as a substratum to the sensitive coating.

There are certainly great advantages attending the adoption of this method; there is not the danger of injuring the film during the operations of developing, fixing, washing, &c., as when simple collodion is used; besides which, not only can a newly iodized collodion be made use of, but almost any collodion—Thomas's, especially, for instance—can be easily rendered fit for dry plates.

I may mention—as I have been wilfully and falsely charged, by interested persons, not only with misleading the public on this

point but with suppressing important facts, a knowledge of which was absolutely necessary to success—I may mention, I repeat, that all the different methods, recommended in my work, of obtaining pictures upon Dry Collodion being at that time equally certain in my hands, I advised the employment of collodion *alone* as being, in my opinion, not only simpler in itself, but requiring less time in the preparation of the needful solutions, &c., and combining, also, economy with facility of manipulation.

With respect to the latter allegation, I can fearlessly state that every detail affecting, in the slightest degree, the success or failure of the learner, was faithfully and freely given to the world.

With these few remarks, which will be no doubt thoroughly appreciated in certain quarters, and which have only been called forth by the base but unsuccessful attempts of a "very select" few to burke my process, I will conclude my preliminary observations, and will now proceed to initiate the reader into the mysteries (if any) of the Dry Collodion Process.

I need scarcely state that a good knowledge of the *Wet* Collodion Process is essentially necessary to those who would successfully practise the *Dry*—a fact not to be overlooked for one moment by those who wish to obtain good results. Such being the case, it will be needless for me to enter into any elementary details of the ordinary manner of coating the plates, &c., and I shall therefore be enabled to devote the whole of these pages to the description of the method of working with Dry Collodion.

APPARATUS, ETC.

The only pieces of apparatus required to be added to the ordinary stock of an operator in the Wet Collodion Process, are a

vertical gutta-percha bath, of a size suitable for the plates he intends to work with, and a drying box, a description of which is given at page 14.

PREPARATION OF THE COLLODION.

As success in this process depends almost entirely upon the collodion, the formula given for its preparation must be strictly adhered to, and the greatest care should be taken to employ the purest chemicals in its manufacture.

The following solutions must first be made. As they do not injure by keeping, a stock of them may be safely mixed:—

TINCTURE OF IODINE AND IODIDE OF POTASSIUM.

Solution No. 1.

Re-sublimed Iodine	1 drachm.
Absolute Alcohol	4 ounces.

When dissolved, add

Anhydrous Carbonate of Soda . . .	1 drachm.

Pour or filter off the liquid, after remaining in contact with the soda about twenty-four hours.

Solution No. 2.

Iodide of Potassium, powdered . . .	2 drachms.
Absolute Alcohol	2 ounces.

Allow these ingredients to be together (shaking the bottle containing them now and then) for about twenty-four hours. After the lapse of that period, add to them

Solution No. 1	4 ounces.
Pyro-acetic Spirit, purified	½ ounce.

In a few weeks the solution, from being of a deep red hue, will become pale and almost colourless. It is then fit for use; and it should, after filtration, be added to the Collodion to be iodized in the proportion stated below.

If the operator wish to use this solution within a few days, he should only add half the quantity of Solution No. 1. This mixture will become sufficiently reduced in colour to add to the collodion in the course of two or three days. If it should still retain its deep red hue after the lapse of that time, and it should be required for use, add it, notwithstanding its red appearance, to the collodion to be iodized, and which, although perhaps not quite colourless, will be fit to use in twenty-four hours.

ETHEREAL TINCTURE OF CHLORIDE OF GOLD.

Chloride of Gold	2 grains.
Iodized Collodion	1 ounce.

Dissolve, and then add

Anhydrous Carbonate of Soda . . .	½ drachm.

The carbonate of soda may always remain at the bottom of the stock bottle, and the quantity of tincture required for use should be carefully poured or filtered off as it is wanted. It must be preserved in a well-stoppered bottle.

SOLUTION OF IODIDE OF AMMONIUM.

Iodide of Ammonium (pure)	80 grains.
Absolute Alcohol	1 ounce.

Dissolve, and filter if requisite.

PLAIN COLLODION.

Gun Paper	1½ drachm.
Washed Ether	1 pint.

Dissolve, and decant if requisite.

If the ether should not dissolve the whole of the gun paper, decant the supernatant clear solution into a clean and dry stoppered bottle, and add to the undissolved portion about two ounces of absolute alcohol—shake it up, and then mix it with the clear fluid. The solution should be allowed to settle, and then decanted into the stock bottle.

The most sensitive collodion is that made with cotton alone; but the use of paper is preferable, owing to its yielding a thicker and more structureless film than the former preparation. If a cotton, and a paper, collodion of equal density be experimented with, it will be found that the latter flows more evenly over the plate than the former, and that the film produced by it is far thicker than that obtained with the preparation of cotton.

IODIZED COLLODION.

Plain Collodion	4	ounces.
Iodizing Solution	5	drachms.
Pyro-acetic Spirit, purified (*pure wood naptha*)	4	drachms.
Camphor	2	grains.
Solution of Chloride of Gold	1	drachm.
Solution of Iodide of Ammonium . .	1	drachm.
Chloroform	1½	drachm.

The ingredients having been added to the plain collodion in the order above given, let them be well shaken up, and when the camphor has dissolved, the whole should be allowed to settle.

Allow me to call particular attention to the fact, that Pyro-acetic Spirit is *Wood Naptha*, and *not* Acetic Acid.

My reason in so doing is simply because it has come to my knowledge that a pharmaceutical chemist, residing in London,

actually used Acetic Acid for the purpose of adding to the collodion, and being much astonished and disgusted at his repeated failures, he gave up the process in despair, and forthwith set down my "Dry Collodion Process" as an utter impossibility.

The collodion does not acquire its greatest degree of sensitiveness until it has become of a pale straw colour—the addition of anhydrous carbonate of soda, in the proportion of one drachm to eight ounces of collodion, will hasten this change.

The collodion when first made is generally structural in appearance; but after the lapse of four or five days it becomes perfect, and fit for use in the camera.

The dosing of the chloride of gold is a point of much nicety, and great care must be taken not to employ too large a proportion of that chemical. The quantity recommended in the formula is somewhat under the mark, the object being to avoid an excess being added, by inadvertence, whilst measuring the tincture. To ascertain whether it be in excess or not, coat a plate, expose under a negative to gas or candle-light, and develop with pyro-gallic acid. If the plate become brown all over, or show reddish stains, especially at the edges of the plate, there is too much gold present; but if it develop clearly and well—let well alone.

A collodion containing too small a proportion of chloride of gold yields pictures slightly wanting in density. It is advisable, however, always to err on the safe side; the addition of nitrate of silver to the developing solution compensating, in a great measure, for the want of gold. A very minute dose of gold being present in the collodion, prevents the necessity of the use of so large a proportion of silver as to injure the details of the picture.

It will be remarked that the amount of camphor in the present formula has been reduced one-half—half a grain, instead of one

grain, being used to each ounce of collodion. The object in making this reduction was to allow the possibility of pyro-gallic acid alone being used in the development, which is then very materially quickened.

The camphor can be dispensed with, if preferred; but I have always found that, besides giving density, the pictures produced by it are more evenly sensitive, and the plates develop more cleanly.

All the preceding solutions, &c., should be preserved in well-stoppered bottles, and be kept in a cool place, to prevent evaporation, and consequent loss; besides, the solutions becoming stronger by the dissipation of the dissolving menstruum, continual annoyance is likely to arise through the use of perhaps an undue proportion of some one of the chemicals.

PREPARATION OF THE PLATES.

The glass plates must be *thoroughly clean.*

Any stains or spots of grease remaining on the plate would prevent the albumen from "taking," and in driving off the excess of solution by heat, the plate would become uncovered at those parts where any dirt might exist.

If new plates, they should be well rubbed, either with a solution of cyanide of potassium, or with a solution of carbonate of soda (washing soda); rain-water being used in either case as a solvent.

A large quantity of clean water should then be poured over them, to remove every portion of the cleansing material used, care being taken to wipe the outside edges. The plates, after draining for a minute or two, to get rid of the excess of water (*but not being allowed to dry spontaneously*), are to be wiped with a

scrupulously clean cloth, and finally polished off with another clean and dry one. The best material for the purpose is that known to ladies by the name of "nursery diaper." It is fine in texture, smooth, and does not become covered with dust or fluff by use and wear.

Should the surface of the plate not appear perfectly clean, it may be moistened with a little alcohol, and finally polished off as before. The application of the albumen is greatly facilitated by the use of the alcohol, which, in fact, ought always to be employed.

PREPARATION OF THE ALBUMEN.

The great objection to the use of albumen is the difficulty of getting the solution perfectly clear and sufficiently limpid to flow readily over the plate. By adopting the following method, the resulting fluid is beautifully transparent, entirely free from "floaters," and is as easily applied as collodion itself.

The solution is to be prepared as follows:—

White of Egg (new-laid)	2 ounces.
Distilled Water	6 „

Beat up with a glass stirring-rod so as to well mix the two fluids, but not sufficiently so as to convert the whole into a frothy mass. Then add about thirty drops of glacial acetic acid (crystallizable). The effect produced should be to precipitate the greater portion of the albumen in a flocculent mass, converting the mixture into a curdy-looking fluid. Some eggs containing more alkali than others, require a greater proportion of acid to partially separate the albumen. The acid should then be added until the flocculent precipitate manifests itself, the fluid being kept stirred during, and after, each addition of acid. When a

sufficient amount has been used, allow it to stand for a few minutes, and then strain it either through a clean piece of muslin or fine sponge, placed in the neck of a funnel. This gets rid of the greater portion of the flocculent deposit, and renders the liquid sufficiently limpid to pass through ordinary filtering paper. It generally requires to be filtered two or three times before it is sufficiently clear for use. Care should be taken to pass it two or three times through the same filter, as, at the first filtration, fibrous particles are almost invariably carried off the paper, and are to be found floating in the liquid. The presence of this foreign matter would produce streaks and stains in the resulting plate.

The albumen will keep good, in moderately warm weather, for about one month. The eggs should be newly laid; if not, it will be impossible to obtain the solution perfectly limpid, however frequently and carefully it may be filtered.

The glass plate must be well cleaned with alcohol, and, if of a large size, placed on a pneumatic, or other plate holder. The albumen solution is then poured upon the plate, facilitating the spreading of it by the use of a glass rod. This last operation is not always required, the albumen generally flowing very readily, especially if the plate have been cleaned with alcohol. When the whole of the surface of the plate is covered, incline it slightly, so as to allow the surplus solution to run off: the bottle into which it is returned should be supplied with a funnel, as the albumen often runs off the plate at half-a-dozen places at once, and much of it is lost. Let the plate drain for about half a minute, and then hold the back of it to the fire, first warming the upper corner of the plate. As soon as it begins to steam, the temperature must be lowered, by withdrawing it to a greater distance from the source of heat. The only guide as to the heat applied

is the amount of warmth that the fingers of the operator will conveniently bear. The plate will be dry in about two minutes.

These albumenized plates may, if desirable, be stored away in plate boxes, and the coating of collodion be only applied as the plates are required for use. In this case, and in very damp weather, the plates, before coating with collodion, must be warmed, to drive off any moisture they may have acquired. It is desirable to mark the plain side of the plate, by gumming on it a piece of paper; the apparent difference between the two sides being so very slight, as to render it difficult quickly to determine which is the albumenized surface. The best test is to breathe on the plate; the moisture will become condensed and visible on the uncoated side, whilst the prepared surface does not show any apparent change.

In the process of coating plates a large quantity of albumen solution should be poured on. By taking this precaution, any particles of dust, &c., will float on the surface and be carried off whereas, were only a small amount to be used, they would be likely to adhere to the glass.

The coating of albumen is readily washed off the glass with a little water; after the plate has been excited, either washing soda or cyanide of potassium must be used to remove the film.

It is perfectly impossible to obtain *very sensitive* dry plates without employing some substance to support the collodion. When collodion is in its most sensitive state, it is extremely treacherous, and will not do for dry plates; by the use of albumen all difficulty is removed. The smaller the quantity of alcohol in the collodion the better it is adapted for Dry work. In that state, if unsupported, it flies off the plate whilst drying. In the Wet process, it is quite the contrary, a large proportion of alcohol being required.

The plates, when dry and cool, are ready to receive the coating

of collodion. This is applied in the usual manner, and the plate then dipped in the following—

NITRATE OF SILVER BATH.

Solution No. 1.

Nitrate of Silver	1½ ounce.
Distilled Water	4 ounces.

Dissolve.

Solution No. 2.

Iodide of Potassium	6 grains.
Distilled Water	1 ounce.

Dissolve.

Mix the two solutions by rapidly pouring the solution of iodide of potassium into that of silver; then add fifteen ounces more of distilled water. By this addition, iodide of silver will be thrown down in such an extremely divided state, as to render it easily soluble in the bath. Allow the whole to stand in a warm situation for forty-eight hours, occasionally shaking the bottle containing it. After the lapse of that period, add one ounce of alcohol to the solution, filter it into a dipping bath, and immerse in it a *wet* collodionized plate, of the size of 6½ in. by 8½ in. Add newly-coated (wet) collodionized plates two or three times in the course of about forty-eight hours: by that time the bath will be saturated with iodide of silver, and will not attack the plates that are afterwards made sensitive in it. It is advisable to keep this bath exclusively for the use of collodion, the formula for which has just been given. One reason for it is, that by use the bath (especially if it contain a large proportion of alcohol) becomes saturated with camphor, and such being the case, on

developing with pyro-gallic acid alone, in the wet process, the plate is blackened all over.

Many failures, especially with beginners, arise solely from the fact of various differently constituted collodions being used with one bath; an endless variety of compounds are thus formed in it, and consequently it very soon gets out of order.

Care should be exercised not to get any pyro-acetic spirit into the bath employed for *wet* plates, as it renders them less sensitive. Therefore it is always advisable to use albumen on the glass, which will enable the operator to employ, for the Dry Process, a collodion that does not contain much pyro-acetic spirit. The pyro-acetic spirit, when used, seems to equalise the sensitiveness of the collodion, and yield very even pictures.

When the bath flows evenly over the surface of the plate, remove it from the dipper, and allow it to drain on a little bibulous paper for a couple of minutes; then immerse it in a vertical bath containing distilled water, and agitate the plate for about two minutes; the plate must afterwards be well washed with common water, and finally a little distilled water is to be poured over it. The object of these washings is to free the plate from every trace of nitrate of silver, the presence of which would give rise to specks and stains in the negative.

The water in the washing-bath will not require changing for several months. By use, it gradually acquires a certain amount of nitrate of silver, the presence of which sensibly aids the development. Should the operator not prepare his own plates, but purchase them ready sensitized, he should dissolve a little nitrate of silver in his washing-bath—say one grain to the ounce.

After having washed the face of the plate, remove it from the stand, and pour an additional quantity of water over the back,

so as to remove every portion of nitrate of silver. Should this last precaution not be taken, the silver is liable to get mixed with the pyro and albumen, when the latter is employed (as directed at page 15) finally to coat the plate, and to stain the negatives obtained.

During the washing of the plates avoid touching the face of them with the fingers; if it is required to elevate them, do so by applying the finger to the under surface of the glass. The object is to prevent the formation of stains at the edges, arising from contact of the plate with the fingers, which may be contaminated with nitrate of silver.

But the best plan to adopt is always to have a basin of clean water by your side, in which the fingers should be dipped previously to handling the glasses upon the stand. As I have before remarked, the most scrupulous attention must be paid to cleanliness in each stage of the process, whether wet or dry, and every precaution should be taken to guard against the presence of any foreign matter, either on the plates or in the various solutions employed. Too much stress cannot possibly be laid upon this vital point.

The method I adopt with large plates is to dip the glass into the washing-bath, and then place it on a levelling stand. Pour a large quantity of water (say one gallon) over it, using a clean watering-can for the purpose, and allowing a portion of the water to remain on it whilst another plate is being prepared. I then wash off with more water, and finally rinse, as before, with distilled water.

DRYING THE PLATES.

After standing on bibulous paper to drain off the greater part of the water, they must be put aside to dry, in a place free from

dust. The plates, especially in cold weather, take a long time (sometimes a day) to dry, owing to the camphor present in the collodion. This is a great drawback when the plates are required to be prepared in a hurry. I have therefore contrived a drying box to meet such cases, and which I will describe. The box must of course be made to suit the size of the plates operated with. In the following description it is intended for plates 10 in. by 12 in. and under:—Make a box, 2 feet long, 12 inches wide, and 14 inches high, inside measurement. Let one side of it slide in a groove, so as to enable the plates to be placed in it. Let the bottom of the box be formed of slips of wood, one inch wide, $\frac{1}{4}$ inch thick, and about one inch apart, extending from end to end; under these, and forming the outside covering of the bottom, is an iron plate, by means of which, and the aid of a spirit lamp, heat can be conveyed to the plates contained in the interior of the box. At the top an aperture must be made, to allow the moisture to escape. When in use, this should be covered with a piece of fine muslin, to prevent the entrance of any flying particles of dust; at all other times it should be closed with a suitable lid. In the interior of the box, and running down the centre of it, slips of wood, $1\frac{1}{2}$ inch wide, and $\frac{1}{4}$ inch thick, must be fixed nearly perpendicularly, and at such a distance from each other, that when the plates to be dried touch the top of one of the uprights, and the bottom of the adjoining one, they shall incline at an angle of about 80°.

Care must be taken that the plates do not touch the wood anywhere but at their extreme edges, otherwise the collodion is liable to dry unevenly. The temperature at which the plates are dessicated should not be much above 60° Fahr.

If all the foregoing directions have been carefully attended to, the coating of collodion will be nearly transparent, clear, and

perfectly structureless, and will retain an uniform sensitiveness for three months, or even a longer period.

It is a decided advantage to wash the plate, after it has been thoroughly deprived of every vestige of nitrate of silver, as directed at page 12, with a mixture of equal parts of albumen solution (page 8), and of the ordinary pyro-gallic developing solution. The development is thus materially quickened—the picture making its appearance on being taken from the washing-bath, and the plate is also rendered more sensitive. Pyro-gallic developing solution can be used alone to wash the plate, which seems to be rendered still more sensitive than when it is mixed with albumen.

The pyro-gallic acid used for this purpose must be perfectly pure, otherwise the plate is liable to become stainy.

The plates may afterwards be placed in an ordinary plate box; great care being taken to exclude all white light from them.

The stock box for sensitive plates should be used solely for that purpose, *i.e.*, sensitive plates only should be placed in it; otherwise, if used indiscriminately for sensitive or finished plates, it would be likely to become contaminated with hyposulphite of soda, and the result would be stained or spoiled negatives.

I may mention, by the way, that during my researches, the greater part of the preliminary experiments were performed simply by the aid of artificial light, and it was only when the method under investigation gave some promise of success, that I operated with it out of doors. It will consequently be seen that it is quite possible to become almost perfect in the process without once practising in the open air. The plates can be coated, sensitised, and dried, exposed under a negative or a transparent positive, to either gas or candle light, developed, fixed, and finally varnished, without the necessity of leaving one's fireside; more-

over, the failures (which every learner must expect), will not be attended with as much trouble and expense as if every plate were to be carried into the field, while at the same time a knowledge of the manipulation will be as readily acquired in the one case as in the other.

When large plates are to be coated (and especially when the views to be taken comprise extensive sheets of water), use a thick, but slightly iodized, collodion. Thomas's negative collodion, when mixed in equal proportions with the prepared collodion for dry plates, answers admirably for large surfaces of water.

A thick collodion is recommended, inasmuch as a thin coating, being more readily attackable, sometimes yields a negative dotted over with minute holes, which would be rendered very perceptible in the water.

As a general rule it is always well to use a thickish collodion.

EXPOSING THE PLATES.

The time of exposure in a clear bright light, when all is in proper order, with a Lerebours three inch single achromatic lens, and one inch diaphragm, is from 2 to 10 minutes—the time being regulated by the amount of light, the nature of the object, the time of day, and the direction of the wind. For instance, a landscape, with dark green foliage, will require a long exposure; if the subject is of a variable nature—say, a white house, with large masses of dark green foliage, as before—the house must be completely overdone in order to bring out the trees. In deciding upon the length of exposure to be given, the high lights (which ought always to be overdone) should not be taken into consideration at all, the sole guide being the middle tints of the picture. The exercise of much judgment on the part of the

operator is absolutely necessary on this most difficult point. Long practice only will enable him to decide upon the requisite time at once, without chance of error: as the plates are only developed at home, and when one is perhaps miles distant from the spot from whence the views were taken, much annoyance will be avoided by paying early and particular attention to this important part of the operations.

In all cases, it is far safer to over, than to under, expose; in fact, generally speaking, there are more failures arising from under-exposure than from almost any one other cause. If not properly exposed, the development will extend over a very long period—sometimes 24 hours, with pyro-gallic acid alone. It is true that under-exposed pictures, taken with an even light, will generally turn out well, notwithstanding the length of development; but this waste of time is very objectionable.

The light seems most active with a north-west wind, and least so when the wind is in the east or north-east quarter.

For stereoscopic pictures (the plates being washed with pyro-gallic acid and albumen) the exposure with a $\frac{1}{4}$ plate lens, $1\frac{1}{4}$ in. stop, is from 10 to 25 seconds; the latter amount being the greatest ever required.

With a double combination lens, in a glass room, I have obtained very fine negative portraits in 50 seconds. I have hitherto confined my experiments to the production of a collodion suitable for landscapes only, but I have, in the course of these trials, seen sufficient indications to convince me that it is far from impossible to obtain a collodion which, when dessicated, shall be as sensitive as any of those used in the wet process.

I have not found that the sensitiveness has been impaired by keeping; in fact, on one occasion, I prepared several plates, some of which were exposed on the following day, and the remainder I was

unable to use until six weeks had elapsed. I found these latter quite as rapid in their action as the former; thus affording me a conclusive proof of the keeping qualities of the collodion. On both occasions the same lens was employed, and the light was of the same degree of intensity.

DEVELOPING THE PICTURE.

The plate, on being removed from the slide, must be immersed for about a minute in the washing bath, and afterwards placed on the levelling stand; then flood the plate with a sufficient quantity of the following solution:—

Saturated solution of Gallic Acid	4 ounces.
Distilled Water	4 ounces.
Acetic Acid	1 drachm.
Pyro-gallic Acid	4 grains.

Dissolve, and filter if requisite.

Immediately before pouring this solution on the plate, add to the quantity above-named, 10 drops of a 30 gr. solution of nitrate of silver.

As the above developing solution rapidly decomposes after the addition to it of nitrate of silver, the amount required for the plate under actual development should only be mixed at one time.

The saturated solution of gallic acid is made by placing an excess—say one ounce—of gallic acid in one quart of distilled water, and shaking it up frequently for a period of about twenty-four hours, during which time it should be kept in a warm situation. The water will only dissolve a small proportion of the acid, which should be left at the bottom of the bottle. As the solution is taken out for use, replenish with fresh distilled water.

The solution of gallic acid will keep good but a very short time, unless about one drachm of pyro-acetic spirit has been previously added to the quantity above-named. In any case, the bottle containing it should be kept full, and well stoppered.

The developing solution should be kept in almost constant motion whilst on the plate.

If time is no object, gallic acid and nitrate of silver alone may be used; the time of developing ranging from ten minutes to one hour.

When the picture is very much over-exposed, as will sometimes happen, bring out the details with the mixture of gallic and pyro-gallic acid, and immediately they have made their appearance, give the necessary intensity with pyro-gallic acid and silver alone.

When the picture is under-exposed, but very little silver must be added at first to the developing solution—two or three drops to four ounces of solution being quite sufficient. When all the details are out, the remaining proportion of silver solution may be added.

Great attention must be paid to the development when pyro-gallic acid alone is used, the solution being kept continually in motion, and poured repeatedly on and off the plate; if this precaution be not taken, the skies and high lights are very apt to become mottled and uneven in appearance.

The same remarks apply to an over-exposed plate, and when a large quantity of silver is used in order to bring out the details of the picture.

Should the solution become dirty and covered with a floating film during the development, reject it, wash the plate with a little *distilled* water, and continue developing with a fresh quantity of solution to which a few drops of silver have been added.

Rinse the measure with *distilled* water previously to mixing the solutions—ordinary water decomposing the chemicals, and giving rise to defects on the plates.

The easiest and quickest way of developing stereoscopic pictures is to place a number of them, face upwards, in a dish containing a saturated solution of gallic acid, with a few drops of nitrate of silver, and to let them develop gradually, examining them now and then. As the details appear on each plate, take it out, wash with distilled water, and finish off with pyro-gallic acid alone, containing a small proportion of silver solution—say, two drops to the ounce.

Gallic acid should always be used for the development of stereoscopic plates; every detail is given, the half-tones are perfect, and the lights are well rendered—points most important in small pictures.

It is better, also, to develop under-exposed pictures with gallic acid alone, and when the details make their appearance, to give density with pyro-gallic solution, containing one drop of a 30-grain solution of nitrate of silver to the ounce. The time of development is much lengthened when gallic acid is employed.

When collodion is in its most perfect and sensitive state, the plates prepared with it can only be developed with gallic acid, inasmuch as the camphor and chloride of gold are then present in too great a proportion to allow of pyro-gallic acid being used without staining the negative.

Finding that a lengthened development was objected to by the public, I modified the formula for the collodion, so as to enable the operator to employ the ordinary pyro-gallic acid solution, the development being materially quickened in consequence. For my own part, however, I decidedly prefer the original formula. That collodion certainly demands greater skill

on the part of the operator, as it is more difficult to manage than the collodion made after the formula given in the present work; still I prefer it, notwithstanding the extra amount of care required, as it yields pictures exquisitely soft and delicate.

When the plate has been washed with pyro-gallic acid and albumen previous to exposure (as directed at page 15), the picture, if exposed the proper time, will be quite apparent on removing the glass from the washing bath. If it has been much over-exposed, the picture will be very faint, and the colour will be an extremely light pink; it will be perfectly useless to attempt to develope such a plate. If under-exposed, the high lights only will make their appearance; in such a case the plate may be saved by developing with gallic acid alone—a few drops of nitrate of silver solution being added when the details of the subject have made their appearance. The development will be a long one, extending perhaps over twenty-four hours. It will not require much watching.

I may remind the operator that it is not essential that the plates should be developed the same day; this may be left till convenient. Sometimes I have kept them six and eight days after exposure, and have obtained in every case first-rate results. Still, I should recommend beginners to develop the same day, if possible.

FIXING THE PICTURE.

When the picture is well developed, fix with a solution of eight ounces of hypo-sulphite of soda dissolved in one pint of water, and then well wash the plate with an abundance of water.

If the picture obtained is much too dense, owing to over-development, fix with a weak solution of cyanide of potassium, 1 drachm to the pint; watch narrowly the effect produced, as this salt attacks the half tones very rapidly, and is liable to destroy

the picture entirely if left too long a time on the plate. The proper amount of intensity is attained when, on holding the negative up to a strong light, you can just see through the darker portions of it.

The plates must be allowed to dry spontaneously in a warm situation. When perfectly dry, coat with either chloroform varnish, or with any other description that may be preferred. As the plate can be heated without fear, spirit varnish can be employed, and this kind seems better calculated to protect the plate than any other I have tried.

VARNISH.

The selection of a good varnish is most important; unless much attention is paid to this one point, negatives of great value, impossible perhaps to renew, may be irretrievably lost, through becoming scratched and otherwise damaged whilst being printed.

Amber and chloroform varnish (though convenient to use, not requiring heat) does not protect the negatives nearly so efficiently as the spirit or benzole varnishes.

I had been very much annoyed by my negatives being injured when I least expected it. I therefore set to work, and made some experiments with a view to obtain a varnish, hard, not easily scratched, and that would not soften in the sun, and I am happy to say that I have perfectly succeeded. The menstruum is benzole, and it will dry pretty readily without heat. It is better, however, to warm the plate slightly after the application of the varnish, as this tends to render the coating still harder. This varnish can be obtained, by order, through the various photographic warehouses, or at No. 64 A New Bond Street, London.

A very pleasing application of the dry collodion, is to the preparation of transparent positive slides for the magic lantern.

Negative (the same) collodion is to be employed for the purpose of producing positive pictures; the time of exposure in the sun is from one to five seconds.

Confirmative Experiments, &c., on the use of Camphor, Acetic Naphtha, Alcohol, Acetic Acid, Iodine, Chloride of Gold, &c.

Having described the easiest way of producing negatives on Dry Collodion—that which is most calculated to succeed in the hands of the majority—I will now proceed to give my reasons for employing the different chemicals I recommend, to enter slightly into the details of other very successful though more difficult processes, and, at the same time, to draw the attention of the operator to a few interesting facts eliminated during the course of my experiments.

CAMPHOR.

In 1854 I made numerous experiments with camphor, believing it had preservative qualities; amongst other methods, I tried the following:—I coated a plate one evening, excited it in a nitrate of silver bath in the ordinary way, and thoroughly washed it with distilled water to ensure its being free from nitrate of silver. I then immersed it in a camphorated bath, made by placing an excess of pulverized camphor in distilled water, and allowing it to stay until the water had become saturated with it.

The iodized plate was allowed to remain in the camphorated bath until required for use, the time being, in this case, forty-eight hours; it was then removed, drained, placed in the camera slide, and exposed to light. The plate did not seem to have become less sensitive by its long immersion in the camphor bath, but the picture produced was not clean, presenting the appearance of a collodionized plate prepared in an alcaline bath. This I attribute

to the camphor not having been washed away from the plate, and also to my using pyro-gallic acid as a developing agent. The picture should have been developed with gallic acid alone, as when camphor in excess, and pyro-gallic acid, come in contact with each other on the plate, the latter is blackened all over.

Supposing, therefore, there is more than half a grain (the maximum quantity) of camphor to each ounce of collodion, it would be impossible to develop with pyro-gallic acid, and gallic acid must then be employed alone.

The proportion of camphor should not be more than half a grain to each ounce of collodion. The advantages to be derived from its use are the following:—It gives additional power to the negative—it renders the collodion less liable to disconnect itself from the glass plate—it prevents the collodionized plate from drying too quickly; and affords the operator, when used for the Wet Process, more time between the exposure and the development of the picture.

ALCOHOL, ACETIC ACID, AND ACETIC NAPHTHA.

I find, from experiment, that it is impossible to obtain a collodion, suitable for plates of a large size, if ether and alcohol alone be used in its manufacture; the reason is, that alcohol cannot be employed in such a proportion as to render the resulting collodion non-contractile. I therefore add acetic naphtha, which equalizes the collodion, and renders it uniform when the plate is coated. Acetic naphtha is preferable by far to alcohol, as about ½ an ounce of the former only is required to obtain the same result as would be attained by 1 ounce of the latter. The collodion is also rendered perfectly structureless by its use.

Acetic acid expands the collodion: for this reason I add acetic acid to the gallic acid developing solution. Gallic acid alone tans, as it were, the collodion film, and renders it tough and contractile.

When there is much pyro-acetic spirit present in the collodion, the plate must not be immersed as rapidly in the bath as when ether and alcohol alone are used in its preparation; the pyro-acetic being much less volatile than the latter fluids, takes a longer time in setting, and were the plate to be placed in the bath too soon, it would become streaky all over, similar in appearance to an over-iodized film.

IODINE.

I have found Iodine most useful in giving power to the negative; but it should not be used without neutralizing the acid with which it is sometimes contaminated, otherwise it would considerably interfere with the sensitiveness of the collodion. The readiest way of depriving the iodine of its acidity, is to add to the alcoholic solution of it a small quantity of anhydrous carbonate of soda. This salt not only renders the solution perfectly neutral, but also possesses the property of absorbing and separating any water that may possibly be present in the alcohol.

After making numerous experiments with various chemicals, chlorides, bromides, iodides, &c., I have arrived at the conclusion that the best sensitive solution is that described at page 3.

The action of sublimed iodine upon the collodion is somewhat remarkable, inasmuch as the reddish tone imparted to the collodion by its addition to it is not retained permanently, as one would imagine; but when a small quantity of acetic naptha has been added to it, in the proportion stated at page 5, it undergoes a somewhat rapid change, acquires finally a pale straw colour, and it will then remain equally sensitive for almost any length of time. Should I wish to take a photograph of a landscape with large sheets of water, (a view, for instance, similar to that "From Richmond Bridge," now publishing in the 4th number of

"Photographic Art Treasures") I would employ a collodion iodized principally with iodine, as less alcohol is then required than when iodide of potassium is present in a proportionate quantity. For such views, the smaller the amount of alcohol in the collodion used the better.

If the collodion is iodized with iodide of potassium, the solarized parts of the picture (such as the water) will become filled with minute holes on the addition of nitrate of silver to the developing solution for the purpose of giving those particular portions sufficient density to enable them to print with effect.

When too much alcohol is present in any collodion, the film is flaky, and the same effect is likely to be produced should there be too small a proportion of that fluid contained in the collodion. It must be borne in mind that it is not absolutely necessary that a collodion should be made to suit each particular view that is required to be taken, as the ordinary collodion will answer every purpose; still, when utmost perfection is the aim, every available means must be taken in order to ensure a commensurate result. It is a knowledge of these facts that constitutes excellence in photography.

When collodion is freshly iodized, it can be rendered fit for immediate use by the addition of a few drops of tincture of iodine. The plate must be previously coated with albumen. Thomas's collodion is readily made available for dry work by the addition of tincture of iodine, in the proportion of from four to six drops of tincture to one ounce of collodion.

CHLORIDE OF GOLD.

It is perfectly optional with the operator to use or to reject the chloride of gold given in the formula.

I have employed it with a view to obtain greater power and increased sensitiveness. It should be added in exceedingly small quantities. It is a very deliquescent salt, and is, therefore, best kept in solution. For that purpose I dissolve 2 grains of chloride of gold in 1 ounce of iodized collodion; and as with these proportions there is $\frac{1}{2}$ a grain of the chloride in every 2 drachms of solution, it is very easy to measure off the requisite quantity, and to add it to the collodion.

In the formula, at page 5 I have given the maximum quantity that should be used; any further increase would have the effect of blackening the plate all over during development, upon the addition of nitrate of silver. In any case, however, the difficulties of manipulation are heightened by the use of this salt.

It is indispensable to obtain the chloride of gold as free as possible from acid; due precaution should also be used in its purchase, as much of this salt offered for sale is very impure.

CHLOROFORM.

The addition of chloroform to the collodion, in a suitable proportion, increases its sensitiveness very materially.

The quantity generally recommended, viz., from five to ten drops to the ounce, is not nearly large enough. Fifteen drops, at the very least, should be employed, the collodion being hardly affected by the use of a smaller amount. I have employed it very beneficially in the proportion of sixty drops to one ounce of collodion.

The collodion must be allowed to settle for about four days. If used before that time it will be found that the chloroform has not undergone its change, and that the film will be full of minute holes (similar to air bubbles) at the corner of the plate at which the collodion has been poured off.

ALBUMEN.

A combination of albumen and collodion will be found exceedingly useful, especially in cases when it is desirable to keep the plates sensitive for six or eight months, or even for longer periods. The albumen must be diluted as follows:—

White of Egg	2 ounces.
Distilled Water	12 ounces.

Beat it up until the whole is converted into a white froth; allow it to stand in a cool place for twenty-four hours, and filter through bibulous paper or fine muslin.

Having excited your plate, and thoroughly freed it from nitrate of silver, as described at page 12, place it on a levelling stand, and pour over it a sufficient quantity of the above albumen to cover it entirely. Pour on and off the plate two or three times, let the plate drain for a few minutes, and place it in the drying box described at page 14. This slight coating of albumen tends wonderfully to preserve the sensitiveness of the plate; but it requires more careful manipulation in its application, and, besides, takes up more time, than by the use of collodion only.

In experimenting with gelatine, I have always found that plates coated with that substance were much less sensitive than when albumen had been used. The latter seems to assist in giving power to the negative, whilst the former does not possess the same quality. The coating of albumen being very thin and perfectly transparent, it does not in the slightest degree affect the exposure of the plate.

AMBER VARNISH.

The glass plates may, in the first place, be coated with amber and chloroform varnish, and then with collodion. This has the

effect of making the plate more sensitive, and, in my hands, has been successful with plates 10 in. by 12 in.

The varnish, however, is liable to render the collodion rather brittle, and to cause it to crack and flake off the glass. It is, also, expensive, which will no doubt debar its use in many cases.

INDIA-RUBBER AND BENZOLE.

India-rubber is a useful adjunct in the preparation of dry plates. The following details of the method of application will be found extremely advantageous, especially by young hands, and in cases where large surfaces are to be covered.

The india-rubber, with which the solution is prepared, should be in the unmanufactured, or crude state. I generally select good bottle rubber, and having separated the inner portion, or that which is of a light cream colour, reject the darker part. Having cut it into small pieces, I place a $\frac{1}{4}$ of an ounce of it in a wide-mouthed stoppered bottle, and pour over it 10 ounces of purified benzole. After the lapse of about forty-eight hours it will be found that the whole of the rubber is dissolved. The clear portion of the solution must be decanted off, and the fluid is then ready for immediate use. It should be of such a consistence as to flow very readily over the plate, and to give, when dry, a thin transparent coating, closely similar in appearance to albumen.

The solution is poured on in the same way in every respect as collodion, and allowed to remain on the plate a shorter or longer period, according as the weather is warm or cold. It is then returned to the bottle, care being taken not to raise the plate too rapidly, allowed to drain until it begins to set, and is finally dried off, either by holding it before a gentle fire, or, which is preferable,

applying a moderate heat by means of a spirit lamp. The plate being held in a vertical position, commence drying the plate at the corner opposite to that by which the fluid is poured off, so as to prevent the film from becoming too thin at that end of it.

It is essentially necessary that the elasticity of the india-rubber should be entirely destroyed. This is accomplished by subjecting the plates to a great heat until they become "tacky" to the touch —otherwise the coating is likely to become reticulated all over.

It is unnecessary that the glass plate, intended to be coated in this manner, be ground at the surface as previously directed. Sulphuric ether being a solvent, although but in a slight degree, of india-rubber, the collodion, on being poured on the plate, amalgamates with the dessicated film, forming one and the same substance, and it is impossible to separate them afterwards. It possesses all the stability of albumen, and produces a negative in four minutes. Plates prepared in this way will bear any reasonable amount of rough usage; in fact, it is almost impossible to remove the film from the plate, except by actual hard rubbing.

India-rubber possesses this advantage over all other processes, viz: that almost any collodion may be used, provided always, that acetic naphtha be not present in it. Instead of benzole, chloroform may be employed as a solvent for the india-rubber, and in one respect it is a very good substitute, as it evaporates quickly without the use of heat; but its great expense debars its use, except under rare circumstances, where sources of heat cannot readily be procured. The reader may naturally enquire, 'Could he not take pictures directly with this solution without the intermediate use of collodion?' To this I can, to a certain extent, give a satisfactory answer. I have iodized the solution, and produced very good pictures with it, but its action is exceedingly slow; much more so than albumen.

PRACTICAL HINTS, &c.

I have collected together, under this head, a few scattered observations made during my researches on Dry Collodion and Positive Printing, and which may be of service to the operator.

In order, if possible, to give increased rapidity to the collodionized plates, I have washed them (after being made sensitive and well washed with distilled water) with different developing solutions, and have noticed the following results :—

Pyro-gallic acid developing solution increases the sensitiveness to a considerable extent; proto-sulphate of iron retards considerably the action of the light; and gallic acid possesses the same property, and in the same degree.

Plates that have been treated in this manner, develop more rapidly than when used in the ordinary way; but they require careful manipulation, as they are very liable to become stained and spotty.

It frequently happens that whilst making experiments in pursuit of one object, we are led to the discovery of others, sometimes of more importance than the original one. In this way, I believe I have discovered a new method, by means of which old collodion may be decolorized, divested of its acidity, and restored to its original sensitiveness. The way I proceed is as follows :—

Take any quantity of old collodion, say 16 ounces, and add to it 1 ounce of anhydrous carbonate of soda, and about 4 drachms of acetic naphtha; shake the mixture occasionally until decolorized, which will take place in about a couple of days: less naphtha will suffice, but it will take longer to decolorize. I should, however, advise the operator, as a general rule, to use

less, especially if the collodion which has to be decolorized is not very old. In that case a very small quantity of naphtha will do. The operator will not find any disagreeable odour arise from the naphtha contained in this collodion, the quantity being so very small as to render it scarcely perceptible.

This method is far preferable to that in which metallic silver is used as a decolorizer; it does not over-do what it is intended to accomplish; besides, the carbonate of soda absorbs any water that may be present in the collodion, rendering it perfectly structureless. When the collodion has changed to a pale straw colour, the supernatant clear fluid may be poured off for use, or may be allowed to remain in contact with the carbonate of soda until required. In any case, after it has been treated in the way I describe, no further change will take place in its colour, and it will retain its sensitiveness uniformly for any period. A small quantity of this restored collodion, added to a fresh batch, renders the latter fit for immediate use.

When collodion, containing simply ether and alcohol, has only been iodized a few days, and has become reddish and less sensitive, the addition of 30 drops of pyro-acetic spirit to each ounce of such collodion will restore its sensitiveness, and prevent any further change in its composition.

During the course of my photographic experience, many nitrate of silver baths, that had been used for exciting collodion plates, have been placed in my hands to determine the reason they could not be made to produce a sensitive plate. In the majority of cases I found that acetic acid had been added to the bath, generally in excess, and on the addition of ammonia, to neutralize the acid, acetate of silver was immediately formed, thus weakening the bath to a considerable extent.

To evaporate the liquid would involve much time and trouble;

instead, therefore, of using ammonia, I employ well-washed kaolin, in the proportion of about two ounces to a quart (40 ounces) of solution, the whole to be well shaken, allowed to stand to settle, the clear fluid poured off, and the remainder filtered through bibulous paper. This is decidedly the best and readiest method of cleansing and decolorising old baths, and rendering them again available for producing sensitive plates. In this way I treat the bath I employ for sensitizing dry plates, when it has become discoloured by use. Kaolin possesses this great advantage—it has the property of making the collodion film adhere more firmly to the glass plate; thus producing an effect similar to that caused by proto-sulphate of iron.

The iodide of ammonium produces greater sensitiveness, but it has the disadvantage of making the collodion decompose more readily.

Should, at any period, the operator exhaust all his stock of Dry Collodion, he can, as a make-shift, use any ordinary negative collodion, after treating it in the following manner:—

Take, say four ounces of iodized collodion, and add to it from twenty-five to thirty drops of tincture of iodine (solution No. 1, page 3). Shake it up for a minute or so, and, after being allowed to settle, it will be fit for use. This mixture yields a powerful negative, but it is not quite as sensitive as the collodion prepared after my formula. It is, therefore, only recommended in extreme cases, where a negative is particularly required, and no means exist of procuring a supply of a more suitable collodion. It is better if the collodion contain but a small quantity of alcohol, as the results are not so delicate when there is a large proportion present. Albumen must be used as a substratum with this collodion.

The addition of the iodine renders the pictures more vigorou

and prevents the occurrence of minute holes in the solarized portions.

If, at any time, through a continuance of unfavourable weather or other causes, it will have been found impossible to expose plates that have been prepared for six months or more, their sensitiveness may be restored by enclosing them in a plate box, at the bottom of which half-a-dozen drops of chloroform have been placed, and in which they may remain until wanted.

It is very objectionable to use a large proportion of silver in the developing solution, as the solarized portions of the pictures are invariably attacked. One method I have found advantageous is to saturate the silver solution with chloride of silver. I generally put about 1 drachm of chloride of silver into a 4-ounce bottle, and fill up with a 30-grain solution of nitrate of silver; after a time, the solution becomes saturated with the chloride, and in that state is less liable to attack the skies, &c., when added to the developing solution.

It is always advisable, whether working with the Dry or the Wet Processes, to use glasses somewhat larger than the picture you wish ultimately to obtain. By taking this precaution, you are enabled to reject the imperfect portions of the photograph, which are generally to be found at the margin of the plates.

The greater part of the View-lenses by English makers are made of too short a focus, so that small stops have to be used (cutting off almost all the light), in order to obtain sharpness over the whole of the plate. For instance, single lenses for 10×8 pictures, are generally made 15 in. in focal length, and the stops supplied are $\frac{3}{8}$ in., $\frac{5}{8}$ in., and $\frac{1}{2}$ in. The lens I work with (a 3 in. Lerebours) is about 21 in. focus, and consequently will work sharp up to the edges with a one-inch diaphragm. Greater rapidity is ensured, with less chance of failure consequent upon the motion of the objects to be photographed.

I am much surprised that gelatine still continues to be considered, by a large portion of the Photographic public, an effective preservative agent. Its use was suggested to me by the late Mr. F. Scott Archer. I carried out a careful series of experiments with that substance, and I invariably found that it injured the sensitiveness of the plate to a considerable extent, besides yielding pictures greatly wanting in depth and vigour.

The printing of photographs requires, on the part of the operator, a great deal more skill, care, and attention than until lately was imagined to be necessary. It was thought to be "the easiest thing in the world" to print a photograph, and but little pains were bestowed upon the subject. The inevitable result—one I had long anticipated—followed; the proofs faded, and an almost universal panic ensued amongst the photographic public. Attention having now been fully drawn to the fading of photographs, it is to be hoped that great benefit will be derived from the researches of practical photographers on the subject. One great difficulty lies in the manufacture of the photographic paper, and also in the card upon which the photographs are finally mounted. The operator never knows whether the paper is made with clean rags, or with rags that have been bleached with chloride of lime; this is especially the case with cardboard, which is principally manufactured, for the sake of cheapness, with bleached rags. Now it is utterly impossible to free the pulp from the whole of this chloride of lime, the presence of which in the *paper* is certainly not of much consequence; but in the *card*, it almost inevitably causes all photographs that are mounted upon it to become spotty, and ultimately to fade.

The best card should always be selected. It is certainly higher in price, but then you have the satisfaction of knowing that it will not destroy your pictures.

If the best cannot be readily obtained, use the ordinary

description, which should be made waterproof by rubbing over it, by means either of the finger or of a rag, the solution of india-rubber, the formula for which is given at page 29. This application changes the colour of the paper but very slightly. If preferred, it can be applied to the back of the proof itself.

Paste, either alone or containing alum or other so-called preservative materials, should never be used.

The best article is a solution of equal parts of gum and gelatine, made of the required thickness, into which a little piece of camphor should be placed, which may be allowed to remain in the vessel containing the solution.

The proof may be mounted with solution of india-rubber alone: but it has this disadvantage—viz., that if the photographs be not laid down properly at once, it is impossible to remove them from the card in order to correct the error. Many of the so-called *albumenized* papers (and especially the French papers) in the market will, upon examination, be found to be *gelatinized*. In the first place, these papers are less sensitive, owing to the gelatine present; the pictures obtained are invariably flat, and wanting in power; besides which, the gelatine, being hygrometric, is certain to attract moisture from the atmosphere.

Albumenized paper that has an offensive smell is not fit to use, and should be discarded. In the preparation of albumenized paper, it is found much easier to employ the albumen in a semi-putrid state, or after it has been kept some time, than to use a newly-mixed solution. By keeping, it becomes quite limpid, and is applied to the paper without the slightest difficulty: when fresh, it requires greater skill on the part of the operator, besides occupying more time. Manufacturers of albumenized paper almost invariably employ old albumen. It is utterly impossible to obtain permanent photographs upon a paper so prepared.

The use of alum has been recommended in order to preserve the

paste. I was led to believe, at the time, that this addition would prove beneficial, but all my pictures (luckily, very few) mounted with paste containing alum, have since faded.

The water in some districts is quite unfit for washing proofs; the water supplied to the West of London possesses that disadvantage. In order to render any proofs that may be printed at the West End permanent, I am obliged to wash them finally in distilled water. I now print and fix all the pictures at my own residence. The water there is supplied from the New River, which is very good for the purpose.

Water that is contaminated with iron is highly objectionable; it will frequently become impregnated with this metal whilst passing through newly-laid water-pipes. As in London, the mains are constantly being repaired or renewed, many failures are liable to result from this (to the operator) unknown cause. Very hard water (containing lime) is not at all suitable. In the course of some experiments made with the view of testing the qualities of the water supplied by the different companies, I have found pictures that had been washed with hard water fade in less than three months.

During the whole course of my experience, I have never known pictures produced with silver alone to remain permanent for any lengthened period—gold is the only true agent for producing permanency in photographs. The chloride of gold (which should be procured from a respectable house) must not be used in too large a proportion, else the tone produced will not be a pleasing one. It should be as free as possible from acid. Very fine tones can be produced upon a paper prepared in the following way:

The paper (the best German) must be immersed for about one hour in a solution of chloride of zinc, containing from 10 to 15 grains of chloride to each ounce of distilled water. When dry,

excite with a 30-grain solution of ammonia-nitrate of silver. The proofs should be fixed in a saturated solution of hyposulphite of soda, containing from 3 to 5 grains of chloride of gold to the pint.

The paper does not produce equally fine results with plain nitrate of silver solution as with the ammonia-nitrate.

This paper is exceedingly valuable in cases where it is desired to print an over-exposed picture; it will produce a most vigorous proof with such a description of negative: in fact, a fine picture can be obtained by it where all other papers would be utterly useless. The proofs should be but very slightly over-printed; just sufficiently so as to tone over the high lights.

The most beautiful black tones are obtained by the use of the zinc paper if fixed as directed; the proofs are quite permanent.

When finished, the picture can be as readily examined by transmitted as by reflected light. Proofs printed upon this paper are admirably adapted for transparencies.

In printing on albumenized paper, the strength of the sensitive solutions, &c., should be varied according to the character of the negatives to be reproduced.

Vigorous, intense, and under-exposed negatives should be printed upon a slightly albumenized, thin (German negative) paper, sensitized with a weak solution of nitrate of silver, 30 grains to the ounce, or of a strength just sufficient to coagulate the albumen. Over-exposed, faint, pinky negatives must be produced upon a thick, highly albumenized paper, excited with a strong solution of from 60 grains to the ounce. Ordinary negatives, with the high lights slightly transparent, may be printed upon a moderately albumenized paper, sensitized upon a 40-grain solution.

The proofs should not be much over-printed, and should be fixed

in a saturated solution of hypo, containing from 3 to 5 grains of chloride of gold to each pint of solution.

On being taken out of the fixing solution, the proof is to be rinsed in a vessel of water, placed face downwards, on a sheet of glass, and a strong stream of water from a tap allowed to fall on it for two or three minutes; it is turned over, and the same operation performed upon the face of the picture, the water being made to impinge every portion of the photograph; it is then placed in a vessel, the water in which is continually changing, and in which it is allowed to remain for a couple of hours; finally, the proof is rinsed with a little distilled water, and dried. When dry, it is ready for mounting or for waterproofing.

To give pictures upon plain paper the appearance of having been printed upon an albumenized surface, it is only necessary to rub them over with solution of india-rubber (as directed at page 36), and to roll them. The operation gives them a beautifully glazed surface, and renders the paper precisely similar to that which has been albumenized.

Bichloride of mercury (corrosive sublimate) which as yet has been but little used, is calculated to rank high both as a fixing and a sensitizing agent. It is used as follows :—A saturated solution of bichloride of mercury is first made by placing about one ounce of the powdered salt in 8 ounces of distilled water, previously mixed with half-an-ounce of rectified alcohol. Shake up this mixture now and then for twenty-four hours, when the water will have dissolved as much of the bichloride as it will take up.

Two parts of this solution must be mixed with one part of distilled water, placed in a shallow dish, the paper floated on it for five minutes, then taken out and dried. It can only be excited upon ammonia-nitrate of silver. The picture must be printed

exactly to the depth required, as it is not reduced afterwards in the hyposulphite. The prints when taken out of the pressure frame are reddish in colour; on immersion in the fixing solution, they rapidly change to a beautiful blue black. Use the saturated solution of hyposulphite of soda with chloride of gold before described, in which it should remain half-an-hour.

A most singular property of pictures, fixed with bichloride of mercury, is their effect upon faded photographs. This property I accidentally found out some time ago. I had collected together a number of stray photographs, amongst which was one that had faded considerably; so much so, indeed, that but a very indistinct picture was visible. This was placed along with the others in a portfolio. On looking over the pictures, three weeks or a month afterwards, I was much astonished to find that this photograph had regained its original depth and colour. Upon examination, I perceived that the proof had been laying in contact with one fixed with bichloride of mercury, and supposing that that had some influence in bringing about this singular result, I placed some other faded proofs between bichloride pictures, and in every case the same change manifested itself; with some, in fact, the tone was vastly improved.

The tone obtained varies according to the nature of the photograph. Sulphurated proofs, fixed without gold, become of a pinky hue, and are revived but to a very limited extent. Proofs fixed with gold, but which have faded through being badly washed, and having been allowed to become sulphurated in the hyposulphite bath, change to a dark violet tint, approaching to blue-black.

Photographs, fixed without gold, that have faded through want of care in the washing, will acquire a reddish tint.

I have not as yet found any of these restored photographs again fade.

I should advise those who intend to try this easy method, whereby, no doubt, photographs of considerable value may be restored, to prepare some pieces of paper in the following manner:—Make a solution of bichloride of mercury, 10 grains to the pint, and immerse in it, for about half-an-hour, ordinary photographic paper, cut to the required size; then take the paper out, thoroughly rinse it in several waters, and hang it up to dry. The faded photographs are to be placed in a portfolio, with a piece of prepared paper between each, and put away in a dark situation.

In the course of a week, or so, (the time varying according to the extent to which the photographs have faded) the pictures can be removed from the portfolio.

It will be found that the slower the action, the better success will attend the experiment; as, if the paper is prepared with too strong a solution of bichloride of mercury, the proofs are liable to change more rapidly in some parts than in others, and to become patchy all over. If unmounted, the photographs themselves may be immersed in a very weak solution of bichloride; they must be thoroughly washed afterwards in warm water. This plan is a somewhat dangerous one, as all proofs will not stand the severe test. I have, by these means, recovered photographs that had completely lost the whole of the details. If much hypo has been left in the proofs, the mercurial solution will become milky; it must be immediately rejected, as any proofs afterwards immersed in it would inevitably fade.

The fixing solution in every case should be kept as nearly neutral as possible. If acid is employed, use the acetic acid in preference, and in very small quantity.

It is most essential that the hyposulphite of soda should be perfectly pure.

The fixing solution should be used new, *i. e.*, not more than

two dozen proofs 10 × 12 should be fixed in each quart of solution. The quantity of chloride of gold to be used (viz., 10 grains) should not be added all at once; one-half should be poured in, and the rest added as the solution becomes impoverished by use. The bath soon becomes contaminated with chloride of silver; the colour is readily obtained notwithstanding its presence, but the pictures fixed in it are not permanent. They will sometimes even change whilst in the washing water.

It will be perceived, from the above remarks, that to print photographs properly, is more expensive than is generally imagined.

If the gold be deficient in quantity, it is necessary to print the proofs more deeply.

Photographers who have operated much in the field will, no doubt, agree with me that perhaps the most unfortunate accident that can happen is the breaking of their focussing glass, when far distant from any civilised locality. All annoyance from this cause may be avoided by being provided with a small bottle of the following solution:—

Benzole	4 ounces.
White India-rubber	¼ ounce.
White Wax	¼ ounce.

Dissolve by heat if necessary.

An ordinary piece of plate glass, of the size required, is well cleaned in the usual manner, and slightly warmed. The bottle of solution is placed in a basin containing a little warm water, and when perfectly fluid, the solution is poured over the plate, and the surplus quantity allowed to flow back into the bottle. On cooling, the plate will be covered with a thin, but strong, opalescent film, free from all granular appearance, and presenting a beautifully even surface, admirably adapted as a substitute for ground glass.